living matter may and does originate independently during the progress of fermentation in previously germless fluids.

As a result of the fermentative changes taking place in boiled urine or other complex organic solutions, many new chemical compounds are produced: gases are given off, or these with other soluble products mix imperceptibly with the changing and quickening mother-liquid, in all parts of which certain insoluble products also make their appearance. Such insoluble products reveal themselves to us as specks of protoplasm, that is of 'living' matter; they gradually emerge into the region of the visible, and speedily assume the well-known forms of one or other variety of *Bacteria*.

These insoluble particles would thus in their own persons serve to bridge the narrow gulf between certain kinds of 'living' and of 'dead' matter, and thereby afford a long-sought for illustration of the transition from chemical to so-called 'vital' combinations.

XV. "On the Variations of the Daily Range of Atmospheric Temperature as recorded at the Kew Observatory." By Balfour Stewart, LL.D., F.R.S., Professor of Natural Philosophy at Owens College, Manchester. Received May 25, 1876.

(Abstract.)

The daily temperature-range was selected as an element which affords a good indication of the varying meteorological activity of the place, and the observations of which can be easily made and reduced.

The records of the Kew Observatory were chosen because there the atmospheric temperature has been very carefully observed during a long series of years. The writer desires to thank the Kew Committee for giving him access to the records of the maximum and minimum temperatures taken at the Kew Observatory.

Twenty-one years of these records have been reduced, beginning with the year 1855 and ending with 1875. Two complete sun-spot periods are embraced in these observations.

The first Table exhibits (a point already well known) the annual variation of the temperature-range, which is greatest in summer and least in winter.

The same Table shows that the yearly means of this element exhibit considerable fluctuations amongst themselves. Thus we have corresponding to the years 1856, 1866, and 1875 the values 12°·69, 13°·61, and 13°·25 respectively, while corresponding to the years 1859 and 1870 we have the values 14°·52 and 15°·63.

Inasmuch as the three former are years of minimum, and the two latter years of maximum sun-spots, this would seem to show that the daily temperature-range is least for minimum and greatest for maximum sun-spot years.

But, on the other hand, and against this evidence, there is a temperature-fluctuation between 1859 and 1866 as great, or nearly as great, as any which apparently corresponds to sun-spot period. This temperature-oscillation may perhaps be identified with a subsidiary sun-spot fluctuation as exhibited in the curves of Messrs. De La Rue, Stewart, and Loewy, but it is out of proportion to it in relative magnitude.

If we still regard it as most likely, though not proven, both from the evidence of the paper and from collateral considerations, that there is some connexion between the daily temperature-range and the state of the sun with regard to spots, then we may perhaps suppose that this redundant temperature-oscillation is a local phenomenon. There is, however, another possible explanation which will be afterwards alluded to.

It is then endeavoured to ascertain whether the temperature-range has any reference to the relative position of the sun and moon. For this purpose the whole period of 21 years has been portioned out into lunations, each lunation being divided into 8 parts:—(0), (1), (2), (3), (4), (5), (6), (7)—(0) corresponding to new and (4) to full moon.

From the whole series of lunations the following result is obtained:—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Temp.-range......	14·08	14·20	14·29	14·05	13·95	13·83	14·04	14·17

which presents the appearance of a curve of double period superposed upon one of single period. The range, however, is not great.

If we now make use of the lunations corresponding to the six winter months (October to March), we obtain:—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Temp.-range......	11·18	11·37	11·32	10·88	10·52	10·49	10·79	11·05

Treating in the same way the lunations for the six summer months, we obtain:—

Phase of lunation	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Temp.-range......	16·96	17·02	17·23	17·22	17·35	17·15	17·24	17·27

It is then noticed how large and persistent the winter lunar variation is, and how the series of observations may be split into two parts, each of which represents it. Thus we obtain:—

Phase of lunation............	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Winter variation (1855–65)	11·08	11·30	11·24	10·77	10·50	10·76	10·89	10·93
,, (1866–75)	11·29	11·44	11·40	11·00	10·57	10·17	10·69	11·18

Confining ourselves to the winter variation, which it thus appears is very prominent, it is then attempted to show that this variation (as far as we can gather from the Kew observations) appears to vary with the sun-spot period, being greatest at times of maximum spots and least at times of minimum spots, very nearly in the proportion of two to one.

Allusion is then made to certain recent researches of Mr. J. A. Broun, in which he shows that the sun appears to be one-sided as far as his action of certain kinds upon the earth is concerned. From this, and from the fact that while the moon appears to be concerned in the temperature-range,

its influence nevertheless appears to depend on the solar activity (a result similar to that obtained by Mr. J. A. Broun in the case of terrestrial magnetism), it is argued that even if there be a connexion between mean annual temperature-range and the sun-spot period, yet we cannot expect both periods to march together in the same way, inasmuch as the first is due entirely to the sun, while the latter appears to depend upon the moon as well.

This may possibly explain the redundant temperature fluctuation already alluded to; but the discussion of the subject must be further advanced before we can pronounce upon this point.

XVI. "On the Leaf-arrangement of the Crowberry (*Empetrum nigrum*)." By Hubert Airy, M.A., M.D. Communicated by Charles Darwin, M.A., F.R.S. Received May 8, 1876.

(Abstract.)

Pursuing the study of leaf-arrangement, the author finds that the crowberry of our moors (*Empetrum nigrum*) habitually exhibits a peculiar mo le of variation in the arrangement of the leaves on different parts of the same twig. Out of fifty crowberry-twigs taken at random, only four (and these fragments) preserved the same arrangement throughout. In the remaining forty-six the leaf-arrangement was found to undergo a progressive change in ascending from the base of the twig to the summit—a change from a simpler order to others more complex. In general the basal order was that denoted by the fraction $\frac{2}{5}$; and this was found to pass most frequently into $\frac{2}{7}$, which in turn was found to pass into $\frac{2}{9}$, with or without an intermediate set of whorls of 4: $\frac{2}{9}$ generally passed into whorls of 5, sometimes into $\frac{2}{11}$, which was the most complex arrangement that was met with in this plant. The following is a list of the transitions found in the fifty specimens :—

Transition	from	$\frac{2}{5}$ (or $\frac{3}{8}$)	to $\frac{2}{7}$	occurred	22	times.
"	"	do. do.	" $\frac{2}{9}$	"	5	"
"	"	do. do.	" whorls of 5	"	1	"
"	"	whorls of 3	" $\frac{2}{7}$	"	2	"
"	"	$\frac{2}{7}$	" whorls of 4	"	10	"
"	"	$\frac{2}{7}$	" a*	"	2	"
"	"	$\frac{2}{7}$	" $\frac{2}{9}$	"	9	"
"	"	whorls of 4	" $\frac{2}{9}$	"	5	"
"	"	a*	" $\frac{2}{11}$	"	1	"
"	"	$\frac{2}{9}$	" whorls of 5	"	5	"
"	"	$\frac{2}{9}$	" $\frac{2}{11}$	"	1	"
"	"	whorls of 5	" $\frac{2}{11}$	"	1	"
				Total	64	

* By a the author denotes a 4-, 6-, 10-ranked order, such as is found in heads of Dipsacaceæ.